

Appendix 4.1 Review of Historical Incidents Database

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Table A4.1.1 Accidents Related to Methane Storage Tank

Year	Location	Injury	Death	Description	Reference
1992	Turkey	64	32	Explosion in <u>1000m³ storage tank under factory canteen</u> . Suspected methane being pumped in with water. 32 killed due to blast & drowning. 64 injured.	MHIDAS
1996	India	1	3	Tank of methane gas exploded at <u>effluent treatment plant</u> while <u>welding work</u> was being completed on tank's roof. Three workers killed & 1 seriously injured. Workers were trying to prevent gas leaks upon orders of state pollution control officers.	MHIDAS
2002	Australia	0	0	Gas started leaking from <u>gasometer after tank top tilted</u> . Situation worsened as gas was still being pumped into tank. 2km safety zone imposed.	MHIDAS

Table A4.1.2 Accidents Related to Methane Transportation Pipeline

Year	Location	Injury	Death	Description	Reference
1988	US	0	0	2 <u>underground pipelines</u> , one carrying <u>methane</u> and the other <u>propane</u> , ruptured causing an explosion leaving 25ft deep, 30ft diameter crater. Flames were sent 300ft into the air. Firefighter could not approach the fire because of the heat.	MHIDAS
1989	UK	2	0	Pipework being cooled down prior to export of gas. <u>Gas drained into burner</u> and flashed back igniting gas in the vicinity.	MHIDAS

Table A4.1.3 Accidents Related to Biogas in Anaerobic Digestion Plant

Year	Location	Injury	Death	Description	Note
1997	Italy	1	2	In a municipal <u>sewage plant (wastewater)</u> , an explosion occurred during repair work in a concrete silo of a biogas plant. Residue gas and <u>welding operations</u> are the cause of the accident. Two workers were thrown out and killed, and a third one falls to the bottom of the building and was seriously injured. The roof of the silo has been blown.	(i) , (ii), (iii)
1999	France	0	0	In a recycling unit of biogas from the <u>anaerobic treatment plant</u> of a paper mill, an explosion (5kg of TNT) buffer destroyed a balloon of flexible material 10 m and their associated piping supplying a boiler or steam flare safety. The balloon exploded, the railings are bent in a radius of 3 m, the tiles are destroyed within a radius of 20m, cladding and windows on the unit up to 130 m fly into pieces away. There has been <u>no victim</u> . The balloon will be blocked and downhill into depression. Air would be entered by Telfon joints rubbing on the central axis. The biogas has come back and then has formed the explosive mixture which has been ignited by the pilot flame of the flare. An accidental production of hydrogen in the digester and an act of malice were also discussed. Expertise was made. Safety devices were then installed (analyzers, valves, etc..)	(i), (ii), (iii)

Year	Location	Injury	Death	Description	Note
2006	Germany	0	0	At a <u>biogas plant</u> for the treatment of household waste in the vicinity of Göttingen, two fermentation tanks burst, causing around seven million litres of fermentation sludge and rainwater to spread over adjacent fields. A third 20-m-high tank was at risk of collapsing. The mixture ran down from the plateau on which the plant had been built and polluted not only the site but also two bodies of water. There was <u>no risk to the population</u> . However, the bursting force of the standing fermenters caused damage to an adjacent building and a fuel oil tank, from which about 1,000 litres of fuel oil leaked. The amount of the loss was approximately €10m. To date, it has not been possible to clearly ascertain the cause of the loss – it was probably due to a tank failure.	(iv)
2007	Germany	0	0	An accident also occurred at a <u>biogas plant</u> in Daugendorf, near Riedlingen in Southern Germany. The cause of the accident, in which the plant's 20-m-high and 17-m-wide fermenter ruptured, leaving behind a scene of devastation, is still unknown. The biomass in the fermenter spread up to 200 m around the plant. Several items of <u>construction equipment were badly damaged</u> , while the buildings in the immediate vicinity were partially destroyed. Several hundred litres of fuel oil poured out of an overturned tank. The plant had only begun operating two days before. The property damage came to around €1.5m and the business interruption loss to around €1m.	(iv)
2009	Germany	2	1	An explosion occurred at a <u>biogas plant</u> and killed a worker and injured two others.	(v)
2009	India	3	4	A <u>large biogas reactor</u> built in masonry and RCC in Edathala Panchayat Ernakulam District exploded during the commissioning stage, killing four persons and injuring three. The tragedy occurred at 11.30 Hrs on 19th August 2009. The explosion happened when some outlet steel pipe was getting <u>welded or heated by a welder</u> . During the week before the accident, the reactor was partially charged for trial operations with animal dung and other wastes. Gas was getting accumulated and an explosive mixture was naturally building up in the upper spaces of the reactor which could measure a several hundreds of cubic meters. The spark or naked flame from the welding equipment could instantly trigger the explosion of such a large mass of gas-air mix and explosion was severely felt and heard even thousands of feet away. More than a dozen of people were standing on the roof of the reactor or working nearby, when the roof structures caved in as the result of the explosion. Three workers fell into the thick slurry, and one of them was extricated safe with great difficulty and two died, whose dead bodies were recovered later. Workers, standing nearby including the welder, were thrown away by the explosion and two of them died instantly. It was clear that the rule book was violated on several counts. The plant was built unlawfully by the Arabic College Trust.	(vi), (vii)

Note:

- (i) FACTS, <http://www.factsonline.nl/>
- (ii) ARIA, <http://www.aria.developpement-durable.gouv.fr/>
- (iii) Biogas Production - Safety & Regulation, Discussion document for the workshop organized on 24 November 2010 in Paris, Version 09, compiled by Samuel Delsinne, November 2010
- (iv) Renewable Energies, German Insurance Association, Berlin: 2008
- (v) Industrial Fire World, http://www.fireworld.com/incident_logs/incident_log.php
- (vi) Gas Plant Tragedy at Edathala, Visit Report By Er K Vijayachandran FIE And Dr. TV Jacob FIE, Cochin Centre For Policy Initiatives
- (vii) "Four killed in explosion at Aluva biogas plant", The Hindu, 27 August, 2009
- (viii) No record related to biogas accident was found in eMARS database.